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ABSTRACT

While a science teacher needs to be thoroughly grounded in science content and methodology, the science teacher also needs to be a reading teacher. Science experiments and demonstrations need to be integrated with reading in the science curriculum. Reading in science helps students with comprehension, the development of concepts and generalizations, and problem solving. Successful science teaching also includes: discovery learning; experiments and demonstrations; portfolios, journals, and tests; and individualized instruction. The content of science instruction should be significant to the students; related to society; challenging; and constantly assessed. (PM)

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# Assessing Reading in the Science Curriculum.

ED 478 827

by Marlow Ediger

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# ASSESSING READING IN THE SCIENCE CURRICULUM

Reading, as one learning activity in science lessons and units of study, needs to be assessed to notice needs of pupils. The science teacher needs to be thoroughly grounded in science content and methodology and yet also needs to be an instructor of reading. For pupils to do well in reading science subject matter, there needs to be continuous appraisal of how well a pupil is doing and of what is left to be done. A variety of procedures need to be used to evaluate pupil achievement in order to provide data on achieved and unachieved objectives.

Science emphasizes a hands on approach in learning. This is an important way of learning. Reading is another method to acquire scientific information in knowledge and skills.

## Using Basal Science Textbooks and Library Books

One problem in the science curriculum is to integrate reading with pupils doing related science experiments and demonstrations. First, pupils do need to be able to read from the basal/library books in the curriculum. Important ways of assisting pupils to read well and comprehend science content need to be in the offing. When pupils are to read a given selection from the basal/library book, there need to be approaches in helping pupils in word recognition. The teacher or a pupil may pronounce an unknown word to learners without further assistance. The argument given for this approach is that a pupil may continue to read without interruption if the unknown word is pronounced at once. The pupil needs to raise his/her hand at once to let the helper know that a word is not recognized.

In contrast, the argument given against immediately pronouncing an unknown word to the reader is that this does not emphasize a future time to identify an unknown word independently. Thus, context clues may be stressed. Help is then given to the reader in using a technique to identify an unknown word. The teacher assists the pupil to notice surrounding words and guides the reader to put in place a word which makes sense. Sometimes while reading science content pupils will substitute a meaningless word for the unknown. By substituting a meaningful word for the unknown word, the pupil is more likely to zero in on a rightful word. If the word given is still not correct, the teacher might assist the pupil to look carefully at the initial consonant of the unknown word. Most words begin with consonants and they are quite consistent between symbol

and sound. Being able to sound out the initial consonant plus context clue use should do it for the pupil. However, in doing these word recognition techniques, the reader may lose out momentarily on the trend of sequential thought.

Much phonics may be emphasized in reading science content. These learnings would be stressed for those who might benefit from phonics instruction, but only to comprehend science subject matter better. Rightfully, phonics, if taught, belong in the reading curriculum, but is taught in science when stressing reading across the curriculum. There are graphemes (symbols) which relate directly to their corresponding phonemes (sounds). The question then arises, "How much phonics should be taught in reading science subject matter?" In addition to emphasizing initial consonants along with context clues for the pupil to identify unknown words, the pupil may also benefit from looking at ending letters of unknown words to assist in word recognition. As in initial consonants, the ending consonants must be equally consistent to emphasize phonics instruction. Vowel letters individually can vary much in sound such as the long "a," the short "a,' and the "a" governed by the letter "r.". If words or word parts are not spelled consistently between symbol and sound, they should be taught as basic sight words in science.

It is up to the teacher if he/she wishes to teach syllabication skills in reading science content. There are valuable syllabication skills to teach such as the prefix "un," which is used very commonly in writing science subject matter. The science teacher needs to determine how much time is available for teaching word recognition and comprehension skills.

Being able to identify words is important only if it helps pupils to read fluently and thereby comprehend what is printed. One kind of comprehension is to read for facts. These facts must be meaningful and are useful for higher levels of cognition. Facts should be useful in school and in society. Sometimes a pupil, on his/her own, desires to remember facts for the sake of doing so and this is commendable.

Second, reading to develop concepts is very valuable in terms of comprehension. A concept is a single word or phrase. Igneous, sedimentary, and metamorphic, are concepts. Inside of any concept are valuable facts. For example pertaining to sedimentary rocks, pupils should learn how they are formed, what kind of materials make for this kind of rock, and how it is used.

Third, pupils need to learn to read to develop generalizations. A generalization relates concepts, such as "Rocks may be classified as being sedimentary, igneous, and metamorphic."

Fourth, pupils need to read for the main idea. Here, pupils may be helped by having them provide in one sentence what a chapter is about. The sentence must be comprehensive enough to cover the contents read.

Fifth, pupils need to read for a sequence of ideas. The order of presenting these ideas is salient when reading for a sequence of ideas. Too frequently, something is false due to an incorrect order given of events, dates, ideas, and subject matter (See Holt Science and Technology, 2002).

Sixth, cause and effect reading is important in science. There are causes for volcanic eruptions, erosion, hurricanes, tornados, floods, and folding/faulting. These concepts are frequently studied by pupils in units on "The Changing Surface of the Earth."

Seventh, reading to solve problems is salient. Pupils then with teacher guidance identify a problem, gather information for a possible solution, develop a tentative hypothesis, and then assess the hypothesis in a life like situation.

Eighth, pupils need to skim subject matter in order to locate that which is important. Thus, skimming may be done when seeking the right entry in a dictionary, the table of contents or in the index.

Ninth, pupils need to be flexible in word identification and use the approach that is most appropriate in word recognition, be it in using phonics, context clues, picture clues, and/or structural analysis.

Tenth, pupils need to evaluate the self by using meta-analysis skills. Thus thinking about thinking is vital when using meta-analysis in appraising the self in achievement or lack thereof (Ediger, 1996, 45- 53).

## Exemplary Science Teachers

Exemplary science teachers have thought through the entire areas of teaching methods and science content when the instruction process takes place. Varied strategies are used in teaching. Concrete, semi-concrete, and abstract materials are used in instruction. Why? Pupils differ from each other in a plethora of ways and the teacher needs to design instruction which meets the needs of each learner. Methods of grouping then need to be flexible. There needs to be whole group, small

group/committee endeavors, and individual study. How pupils are grouped depends upon the involved purpose. If a science experiment is to be performed, the size of the group needs to be such that all can see clearly and ask vital involved questions. These groups may be homogenous or heterogeneous. The groups may also be based on interest factors or what is purposeful to a group. Whatever the case, the teacher needs to have high expectations for each to achieve and yet be successful at the same time.

Pupils need to be given feedback to indicate how well they are doing on a specific activity or on a group project. With the feedback, pupils may build on what has been learned. Scaffolding can be done based on where a pupil is presently in achievement. Proper rules of conduct helps pupils to achieve more optimally. These rules are to assist and not hinder pupil achievement. An orderly classroom helps each to achieve as optimally as possible. All pupils should be actively involved in the task at hand and not be disrupted by pupil misbehavior.

The teacher needs to encourage quality attitudes among learners. Negative attitudes hinder pupil achievement. Positive feelings toward pupils assists the latter to feel wanted in the classroom. Learners then should be increasingly involved productively in the classroom. Being a good manager of the science curriculum is important. Positive approaches in management makes for a good learning environment. To group pupils flexibly, for example, takes a good manager of learners in the classroom. The curriculum too needs to be effectively implemented. If there is inappropriate sequence between and among classes, pupil disruptions may occur and learning goes downhill (See Morrow, 2003).

There are key methods of instruction to emphasize n the size curriculum. Vital concepts to stress in the teaching of science include the following:

1. Inductive and discovery learning for pupils to arrive at answers to questions.
2. Problem solving and project methods of learning.
3. Experimentation and demonstrations. This is the heart of the science curriculum
4. Key concepts and generalizations to emphasize in teaching and learning (See National Research Council, 1996).
5. Science equipment to do experiments and demonstrations.
6. Portfolios, journaling, and criterion referenced tests to evaluate pupil achievement.
7. Basal textbooks, library books, magazines, and science

encyclopedias.

8. Variety of learning activities to provide for individual differences.

9. Various informal assessment techniques including teacher observation of pupil achievement as well as teacher written tests.

10. Inservice education such as conducting faculty meetings, implementing computer use workshops, and housing a professional library (including Science and Children, and the Science Teacher which are National Science Teacher Association publications (See Mehlinger, 1996).

## Scope and Sequence in Science

Subject matter chosen for pupils to acquire needs to be

1. significant for learners. Trivia and the unimportant must be weeded out since there is much salient content for pupils to learn.
2. useful in dealing with problems in society, such as attempting to solve environmental dilemmas -- saving the natural environment versus exploiting it to seek more jobs for people.
3. important for an educated person to know such as current events dealing with natural phenomenon, e. g. earthquakes and tornados, among others.
4. attainable for pupils in ongoing activities and experiences.

A lack of success is detrimental to a pupil's achievement and progress.

5. challenging to motivate pupils. High expectations for a pupil as a must. Low achievement needs to be substituted with rigor in the science curriculum (See Blough and Schwartz, !995).
6. planned to provide opportunities for pupils to organize and classify content obtained.
7. flexible to encourage pupil input into each science lesson, including questions raised by learners, as well as emphasize pupil/teacher planning.
8. vital in stressing key structural ideas in ongoing units of study.
9. evaluated in using voluntary national standards and objectives and mandated state objectives of instruction.
10. appraised rather continuously to keep abreast with current trends in teaching science (Ediger and Rao, 2001).

## Conclusion

Pupils need to experience a quality science curriculum. The planned curriculum needs to include salient objectives for pupil attainment. The learning opportunities to achieve objectives need to provide for each child's interests, purposes, and achievement level. A good program of appraisal assesses how much pupils have learned and how much is left to learn. Optimizing pupil achievement is a necessity. Carefully designing each science lesson and unit of study should be a requirement.

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